Chapter 7 MODEL CODES, STANDARDS AND PRACTICES

7.1 INTRODUCTION

A contract was issued to Koffel Associates, Inc. of Ellicott City, Maryland, to identify the current model building and fire codes relevant to a structure such as The Station nightclub, as well as to identify the model building codes in place at the time modifications were made to the structure. This chapter reproduces information supplied NIST by the contractor [1], much of it verbatim and without further attribution, although any conclusions and findings that are presented are solely those of NIST.

7.2 CODE HISTORY

Since the 1946 original construction of the building at 211 Cowesett Avenue in West Warwick, RI, numerous model codes have come and gone. Prior to 2000, most model codes were limited to regional adoption. Tables 7-1 and 7-2 summarize the model fire and building codes that were relevant to the structure over its history.

From the 1940's through the 1960's, the prevalent regional model building code in Rhode Island was the National Board of Fire Underwriters, later the *American Insurance Association (AIA) National Building Code (NBC)*, last published in 1976. AIA also published the *Fire Prevention Code (FPC)*, which was the prevalent model fire code in the region.

From the 1970's through the end of the century, the Building Officials Congress of America (BOCA) building code was the leading model code in the region. The BOCA fire code dominated during this period. The BOCA codes were originally named the *Basic Building Code (BBC)* and *Basic Fire Prevention Code (BFPC)*. In the 1980's, BOCA purchased the rights to the AIA codes. BOCA renamed their codes the *National Building Code (NBC)* and the *National Fire Code (NFC)*. While the names were that of the AIA codes, the content was that of the BOCA documents.

In 2000, the International Code Council (ICC) published the first *International Building Code (IBC)* and first *International Fire Code (IFC)*, both now published in 2003 editions [2, 3]. The ICC was formed by the merger of the three regional code writing organizations. As such the IBC replaced the NBC and the IFC replaced the NFC. From 2000 until the appearance of the NFPA building code, the IBC was the only model building code that was being developed and maintained in the United States.

The National Fire Protection Association (NFPA) has published a fire code since 1971 and began publishing a building code in 2003. The NFPA fire code, originally named the *Fire Prevention Code*, was renamed the *Uniform Fire Code* for the 2003 edition [4]. The NFPA building code, Building Construction and Safety Code, is a second model code developed and maintained in the United States. As such, it is included in the code analysis. The Building Construction and Safety Code is commonly known as *NFPA 5000* [5].

The older editions of the BOCA building code treated restaurants and nightclubs differently. To many, a restaurant and a night club may seem to pose similar risks; however, prior to 2000, the codes viewed restaurants and night clubs differently. Even though the codes classified nightclubs and restaurants in different occupancies, it is not always easy to distinguish between restaurants and nightclubs. Below are BOCA definitions of class A-1 and class A-2 structures [6]:

Table 7-1. Applicable Model Fire Code				
Bldg. Permit Date	**Description of Work**	**BOCA: Fire Code**	**NFPA 101**	**NFPA 1**
July 27, 1967	Install paneling; rebuild two porches; install new sign	Basic Fire Prevention Code 1965	Life Safety Code 1967	
May 18, 1970	Roofing Paneling ect	Basic Fire Prevention Code 1970	Life Safety Code 1970	
October 18, 1971	Alterations and remodeling	Basic Fire Prevention Code 1970	Life Safety Code 1970	
November 15, 1974	Interior paneling and partitions	Basic Fire Prevention Code 1970	Life Safety Code 1973	
April 29, 1975	Exterior Alterations and Renovations	Basic Fire Prevention Code 1975	Life Safety Code 1973	
July 1, 1975	Addition 330ft^2	Basic Fire Prevention Code 1975	Life Safety Code 1973	
November 21, 1981	Request of Variation Under Building Code, not enclose stair to basement	Basic Fire Prevention Code 1981	Life Safety Code 1981	
Feburary 20, 1985	Remodel and renovation to existing restaurant	Basic/National Fire Prevention Code 1984	Life Safety Code 1985	Fire Prevention Code 1982
December 9, 1999	Notice of Construction without a permit	National Fire Prevention Code 1999	Life Safety Code 1997	Fire Prevention Code 1997
June 19, 2001	Repair front from car	National Fire Prevention Code 1999	Life Safety Code 2000	Fire Prevention Code 2000

Table 7-2. Applicable Model Building Code		
Building Permits Dates	**Description of Work**	**BOCA Building Code**
July 27, 1967	Install paneling; rebuild two porches; install new sign	1965 Basic Building Code
May 18, 1970	Roofing Paneling ect	1970 Basic Building Code
October 18, 1971	Alterations and remodeling	1970 Basic Building Code
November 15, 1974	Interior paneling and partitions	1970 Basic Building Code
April 29, 1975	Exterior Alterations and Renovations	1975 Basic Building Code
July 1, 1975	Addition 330ft^2	1975 Basic Building Code
November 21, 1981	Request of Variation Under Building Code, not enclose stair to basement	1981 Basic Building Code
Feburary 20, 1985	Remodel and renovation to existing restaurant	1984 Basic/National Building Code
December 9, 1999	Notice of Construction without a permit	1999 National Building Code or IBC 2000
June 19, 2001	Repair front from car	1999 National Building Code or IBC 2000

> **303.3 Use Group A-2 structures**: This use group includes all buildings and places of public assembly, without theatrical *stage* accessories, designed for occupancy as dance halls, nightclubs and for similar purposes, including all rooms, lobbies and other spaces connected thereto with a common *means of egress* and entrance.
>
> **303.4 Use Group A-3 structures**: This use group includes all buildings with or without an auditorium in which persons assemble for amusement, entertainment or recreation purposes as well as incidental motion picture, dramatic or theatrical presentations, lectures or other similar purposes without theatrical *stage* other than a raised *platform*; and which are principally occupied without permanent seating facilities, including art galleries, exhibition halls, museums, lecture halls, libraries, restaurants other than nightclubs, and recreation centers; and buildings designed for similar assembly purposes, including passenger terminals.

Facilities that have seating at tables and chairs for all patrons and serve food are typically considered as restaurants. Facilities that may have some seating and food service, but offer standing and gathering space are typically considered to be nightclubs. Either occupancy may have entertainment and a dance floor. As a tool to assist in determining if an establishment is a nightclub or restaurant, historically, local jurisdictions have compared amounts of food and alcohol served. The ratio of food to alcohol to be classified as one or the other varies between localities.

Converting from one to the other would trigger the change of occupancy provisions of the codes. Historically, the change of occupancy provisions of the BOCA codes required that the building meet the intent of the code for the new occupancy and not pose a greater hazard.

The 1955 National Building Code made no distinction between restaurants and nightclubs. The Code stated the following: "The provisions of this code based on occupancy also apply to conversions of existing buildings and structures or portions thereof from one occupancy classification to another, which would not apply to change from restaurant to nightclub."

It is clear that the proper classification of The Station at the time of the fire was as a nightclub. However, as of the writing of this document, the Town of West Warwick has not made either the historical, or most current, use and occupancy permit for the bar available. It is not possible to determine how the facility was being regulated. Also, it is not possible to determine how the facility was classified when changes occurred to the building. Without accurate knowledge of how the building was classified, assumptions regarding occupancy classification could lead to incorrect conclusions.

7.3 MODEL CODE ANALYSIS

The model code analysis was based upon the *International Building Code (IBC)* 2003 [2] edition and *Building Construction and Safety Code (NFPA 5000)* 2003 edition [5]. A comparison of the relevant sections of these codes is included as Table K-1 in Appendix K. In areas were the codes had dissimilar requirements the impact of both requirements were evaluated.

The *Life Safety Code (NFPA 101)* 2003 edition [7] is a code that addresses life safety issues primarily through regulation of egress and fire safety systems. The provisions of new construction in *NFPA 101* aligned with the requirements of *NFPA 5000*. The *International Fire Code (IFC)* [3] and the *Uniform Fire Code (NFPA 1)* [4] are compared section by section in Appendix K, Table K-2.

Details on the changes to *NFPA 101,* the *Uniform Building Code,* the *Standard Building Code,* and the *BCMC* over the life of The Station and its previous incarnations were also tabulated in the final report from Arup Fire [8].

NIST's technical investigation did not focus on compliance or non-compliance with the specific state or local regulations in effect at the time of the fire, nor did it seek to find fault. Rather, the focus was on model codes and standards and how the design and operation of The Station compared with the guidance provided within them. The findings and recommendations from the NIST investigation are expected to be useful across the nation.

Relevant aspects of the national model building codes are discussed in this section, followed by comments (in italics) on the conditions in The Station that were documented during the analysis. ***It should be noted that the building code evaluation utilizes current building code requirements, which generally are not applied to existing buildings.***

7.3.1 Administration

IBC §105.1 mandates permits for enlarging, altering, repairing, or changing of the occupancy of any building. NFPA 5000 §1.7.6.1.1.1 maintains similar requirements.

> *Comment: Over the life of this building, it was rehabilitated numerous times. A number of the projects were permitted. Typically, descriptions of work included on building permits included Roofing Paneling [9], Alterations and remodeling [10], Addition 30.6 m^2 (330 ft^2) [11]*

Both IBC §109.1 and NFPA 5000 §1.7.6.6.1.3 demand any work that is required to have a permit issued to be inspected.

> *Comment: Limited inspection records for the building were available for review. The inspection records are of fire department inspections, not inspection records for the building department. The reports appear to be from inspections related to renewal of the bar's liquor license.*

NFPA 5000 §1.7.6.6.4 requires the records be maintained for each inspection. IBC §104.7 also mandates that reports of inspections be maintained for the period of time required for public records by the local authority.

7.3.2 Occupancy Classification

IBC §303.1 classifies the occupancy as a Group A-2. NFPA 5000 §3.3.371.1 classifies the space as an Assembly Occupancy.

> *Comment: The use of The Station is consistent with the IBC and NFPA 5000 occupancy classifications of Group A-2 and Assembly, respectively.*

7.3.3 Construction Type

IBC §602.5 classifies the building as Type VB construction. NFPA 5000 §7.2.6 classifies the building construction as Type V (000).

> *Comment: The construction of the building was unprotected wood frame.*

The requirements, IBC Table 602 and NFPA 5000 Table 7.3.2.1, for fire resistance rating of exterior walls are consistent in both codes. In instances were the building is more than 3.05 m (10 ft) from the property line, exterior walls are not required to have a fire resistance rating. For a separation distance

between the building and the property line of less than 3.05 m (10 ft), the codes require the exterior wall to have a 1-hour fire resistance rating.

Comment: The building was more than 3 m (10 ft) from the property line.

7.3.4 General Building Heights and Area

Both codes regulate the height and area of buildings based on occupancy of the building and construction type. IBC Table 503 limits the area of the Group A-2 Type VB buildings to 557 m^2 (6000 ft^2) and one story. NFPA 5000 Table 7.4.1 limits Assembly occupancies with occupant loads greater than 300 and less than 1000 persons of Type V (000) construction to 511 m^2 (5500 ft^2) and one story.

Comment: West Warwick tax records indicate the main floor of the building was 416 m^2 (4484 ft^2) and the basement was 78 m^2 (840 ft^2) [12]

Both codes allow an increase in the area based on open perimeter. The IBC also allows an increase in the height of the building based upon sprinkler protection. NFPA 5000 does not allow the increase in height for sprinklers in this instance.

Comment: The building was not sprinkler protected.

7.3.5 Interior Finish

Both model codes regulate interior finish materials based upon flame spread, smoke production, location in the building, and type of use or occupancy of the space. The IBC, Chapter 8 contains interior finish provisions; in NFPA 5000, they are contained in Chapter 10. ASTM E-84 [13] (or NFPA 255 [14]) is the principal test method used by both codes to characterize flame spread and smoke development. Both codes also allow for large scale testing of interior finishes in lieu of E-84. Tests such as NFPA 286 [15] meet the requirement for large scale testing.

IBC Table 803.6 and NFPA 5000 §16.3.3.3 require interior finishes such as wood paneling, wood sheathing boards, and bead board to have a flame spread rating equal to or less than 75 and a smoke development index equal to or less than 450. In sprinkler protected buildings, both codes allow the flame spread index to go up to 200.

In the IBC, plastics used as interior finish are regulated by IBC §2604. In NFPA 5000, cellular or foamed plastics used as interior finish are regulated by §10.4.3. The IBC requires foam plastics used as interior finish to be labeled, to have a flame spread index not to exceed 75, to have a smoke development index not to exceed 450, and to pass full scale testing. The large scale testing shall be related to the actual use configuration.

NFPA 5000 §10.4.3.1 requires large scale fire tests for foam plastic insulation. The tests must be representative of actual use conditions. The requirement does not make a distinction between foam plastic insulation that is used as interior finish and foam plastic insulation that is used within a wall cavity.

In 1949, no combustible wall or ceiling finish was permitted in public buildings and places of assembly and exits there from that would “spread flame over its surface more rapidly than over one-inch (nominal) wood boards covered with ordinary paint or varnish.” This rather loose standard was replaced in the 1955 NBC by the E-84 test discussed above.

The interior finish requirements have changed little since the 1955 edition. The most significant change in 1967 tightened a previous exception for business occupancies by reducing the allowable flame spread in

rooms or spaces less than 139 m^2 (1500 ft^2). In 1976, the allowable flame spread of exits in assembly occupancies was reduced, and dwellings were regulated for the first time. A separate section was added on floor coverings based upon a "flame propagation index". Neither smoke production nor toxicity has been regulated.

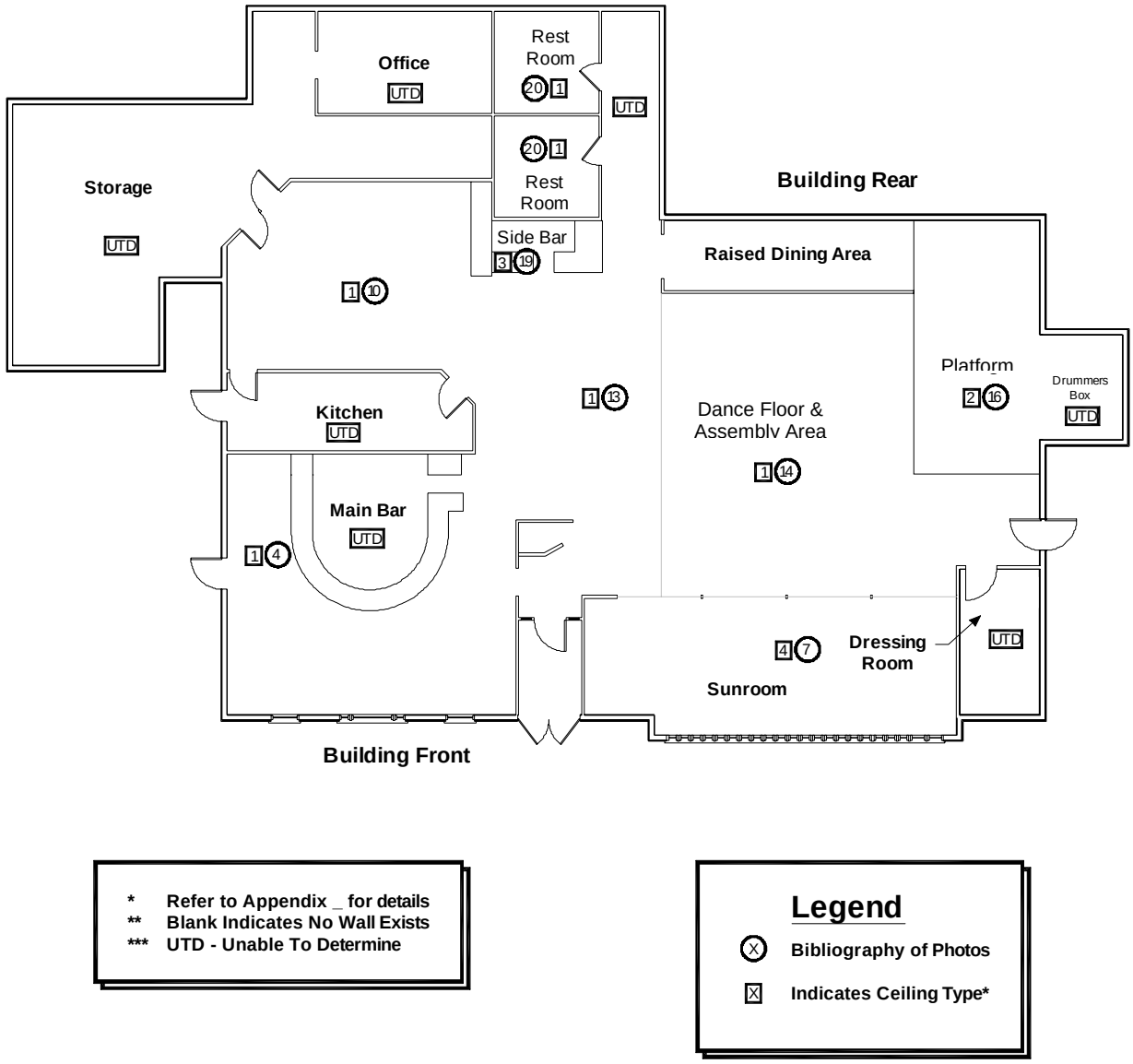
> *Comment: As would be expected, the interior finish materials of the building varied greatly. The interior finish material was mapped and is shown in Figures 7-1 and 7-2. The interior wall finishes included wood paneling, bead board, painted gypsum, wafer board, and ceramic tile. Interior finishes were identified from photographic and video records. The finishes identified were estimates based on a video and photographs taken in the building. The finishes referred to as painted gypsum may be either gypsum wall board or plaster. Neither samples of products nor model and manufacture information were available. Accordingly, conclusions regarding flame spread ratings are based upon broad product categories. The ceramic tile and gypsum do not pose potential interior finish flame spread issues.*
>
> *It appears that there were multiple types of wood paneling installed in the building. Portions of the wood paneling and bead board were painted. Wood paneling is manufactured with different flame spread ratings ranging from Class A to Class C. Many wood panelings are plywoods. Flame spread indexes for plywood range from 70 to 160 [16, 17]. Without knowledge of the specific paneling installed, it is not possible to determine the interior finish classification of the wood paneling at its time of installation. The natural aging and surface treatments applied after installation can dramatically affect the flame spread index of products. The bead board is subject to the same variations in flame spread index due to aging and surface treatments. Without samples to test the class of the interior finish, the flame spread index cannot be definitively stated for either the bead board or paneling. Untreated red oak flooring has a Class C interior finish rating (100 flame spread index).*
>
> *The walls surrounding the stage and the wall to the left of the stage were covered in expanded foam plastic insulation. Additionally, a portion of the ceiling over the stage and the ceiling in front of the stage were covered with expanded foam plastic insulation. The model codes allow foam plastic installation as an interior finish only after large scale testing has been conducted and successfully completed.*

7.3.6 Plastics

IBC regulates plastics in Chapter 26. Chapter 26 has provisions that complement the interior finish provisions in Chapter 8. NFPA 5000 Chapter 48 regulates all plastic materials used in or on buildings.

> *Comment: The tie between Chapters 48 and 10 is not as concise as with IBC. The provisions of IBC and NFPA 5000 are the same. The organization of these codes differ; however, the requirements are the same.*

Foam plastic used as an interior finish shall be the tested in accordance with NFPA 286. During the NFPA 286 test, the room may not flashover nor may flames exit the enclosure. Additionally, total smoke production (a measure of the total surface area of the smoke particles per kg of fuel consumed) shall not exceed 1000 m^2. In the IBC, the requirements for foam plastic to be used as an interior finish are found in §2604.1. §2604.1 requires testing in compliance with §2603.8. §2603.8 requires large scale testing and compliance with Chapter 8 flame spread provisions. NFPA 5000 §48.4.4 contains the same provisions as IBC §2603.8.

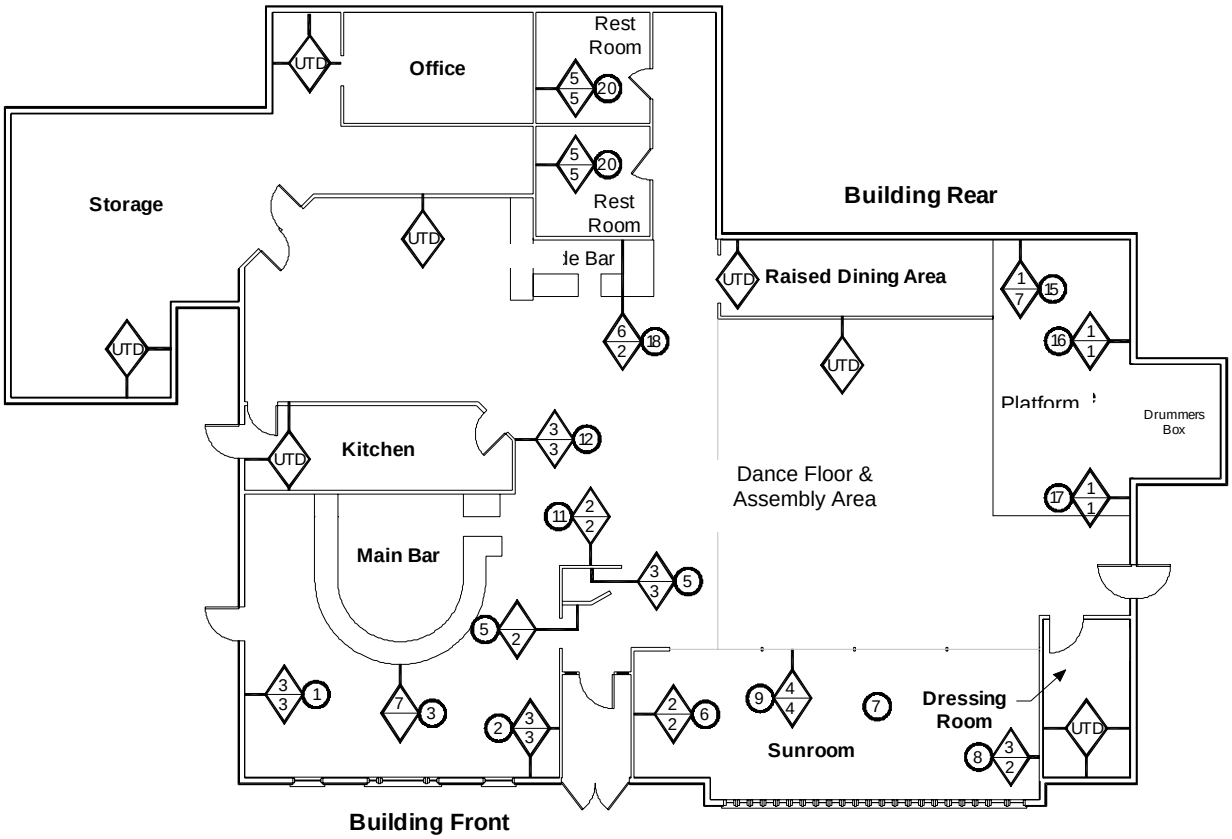


Legend of Ceiling Types

1 Acoustical Ceiling Tile
2 Foam
3 Wood Lattice
4 2x4 Rafters

Figure 7-1. Station Night Club Ceiling Interior Finish

Comment: The model codes prohibit the use of foam plastic insulation as an interior finish that does not pass a large scale test replicating end-use conditions. There is no indication that the foam used on the walls of The Station was tested.



* Refer to Appendix _ for details
** Blank Indicates No Wall Exists
*** UTD - Unable To Determine

Legend

X Bibliography of Photos

Top portion of wall** / Bottom portion of wall** — X / X Indicates Wall Type*

Legend of Wall Types

1 Foam
2 Paneling
3 Gypsum
4 Waffer Boards
5 Cermic Tile
6 Stucco
7 Bead Board

Figure 7-2. Station Night Club Wall Interior Finish

7.3.7 Automatic Sprinkler System

For new construction, IBC §903.2.1.2 requires Group A-2 uses to be protected by automatic sprinklers if any of the following are exceeded:

- fire area > 1114 m^2 (12,000 ft^2)
- occupant load > 300 persons
- fire area located on other than the floor of exit discharge

NFPA 5000 §16.3.5.1.1 mandates automatic sprinkler protection for assembly occupancy serving more than 300 persons. Several exceptions are allowed. None of the exceptions are relevant to The Station.

> *Comment: The model codes trigger sprinkler protection for buildings based on a combination of factors including occupancy, building area, construction type, building height, location relative to exit discharge, and occupant load.* ***For new construction*** *of this type of building, the model codes require sprinklers for an occupant load. in excess of 300 persons. The building was not equipped with an automatic sprinkler system.*
>
> *The BOCA National Building Code would have required sprinkler protection* ***(for new construction)*** *based on the area and construction type of the building. The largest Type 5B Use Group A-2 building the BOCA National Building Code would have allowed is 390 m^2 (4200 ft^2), which is less than the area of The Station.*

7.3.8 Fire Alarm

IBC §907.2.1 requires manual fire alarm systems in Group A occupancies with occupant loads exceeding 300 persons. IBC §907.2.1.1 requires voice notification for Group A occupancies with occupant loads greater than 1000 persons.

NFPA 5000 §16.3.4 requires manual fire alarms in Assembly occupancies with occupant loads exceeding 300 persons. The fire alarm shall be activated by manual pull station, smoke detectors, the sprinkler system, and heat detectors in hazardous locations.

> *Comment: The building was equipped with a manual fire alarm. Manual pull stations were located adjacent to Door 3 and behind the main bar. Heat detectors were located in the area behind the kitchen. Heat detectors were present above and below the platform area. Fire alarm horns were located behind the main bar and in the front room near the pool tables.*

7.3.9 Festival Seating

NFPA 5000 §3.3.474.1 defines "Festival Seating" as a form of audience/spectator accommodation in which no seating, other than a floor or ground surface, is provided for the audience/spectators gathered to observe a performance. NFPA 5000 §16.2.4.1 allows festival seating for assembly occupancies with less than 1000 occupants. IBC does not address festival seating.

> *Comment: At the time of the fire, the nightclub was arranged for festival seating, permitting more occupants than had the building been arranged for fixed seating.*

7.3.10 Exits

There were four exit routes from the building, as numbered in Figure 7-5: (1) the front main exit, (2) the main bar exit on the side, (3) the kitchen exit, and (4) the platform exit. The model codes govern their number, size, placement, and other details of design, as discussed in this section

(i) Doors

Doors shall provide a clear opening of at least 0.81 m (32 in), IBC §1008.1.1 and NFPA 5000 §11.2.1.2.4. Doors shall swing in the direction of egress travel when serving spaces with more than 50 persons, IBC §1008.1.2 and NFPA 5000 §11.2.1.4.2.

> *Comments: All doors exceeded the 0.81 m (32 in) minimum, and all door leaves swung in the direction of egress travel with the exception of the interior leaf at exit 4. (See Fig. 1-5.)*

(ii) Panic Hardware

IBC §1008.1.9 and NFPA 5000 §16.2.2.2.3 mandate panic hardware on doors in the means of egress for assembly occupancies with an occupant load greater than or equal to 100 persons.

> *Comments: When viewed from the exterior, the right leaf of the front doors was not equipped with panic hardware. There was no visible hardware on either door. As of this writing, the type of hardware on the swinging door immediately inside the double exterior doors is undetermined.*
>
> *The door to exit 2 was equipped with panic hardware. As of this writing the type of hardware with which the door at exit 3 was equipped has not been determined. The inward swinging leaf of the door at exit 4 was fitted with standard knob style hardware. The outward swinging door was equipped with panic hardware.*

(iii) Floor Level and Landings

IBC §1008.1.4 and NFPA 5000 §11.2.1.3 mandate that the floor level on both sides of a door shall be at the same level. IBC §1008.1.5 and NFPA 5000 §11.2.2.3.2 also requires that the landing be at least as wide as the stair or door being served and the door when fully open may not reduce the required width of the landing by more than 0.18 m (7 in).

> *Comments: Based on photographic evidence and review of the video, the floor was level on both sides of the main door at exit 1. It could not be determined if the floor was level on both sides of the doors at exits 2 and 3. The floor was not level on both sides of door at exit 4. The first riser was in line with the plane of the closed door.*
>
> *There was not a landing at the exterior of exit 4. The photos of exit 2 indicate a landing outside the door, however, it cannot be determined if a step existed at the door. The photos indicate a stair at Door 3, but it could not be determined if a landing or risers were present at the door.*

(iv) Exit Signs

Exit signs are required at exits other than obvious main exits, and at other locations where exit access is not obvious, per IBC §1011.1. NFPA 5000 §11.10.1.4 and §16.4.7.5 not only require elevated exit signs, but also require floor proximity exit signs.

Comments: The only difference between IBC and NFPA 5000 requirements is that NFPA 5000 requires floor proximity exit signs in assembly occupancies. The nightclub was equipped with exit signs over each of the four doorways.

(v) Travel Distance

Both IBC §1018.1 and NFPA 5000 §16.2.6 require the travel distance to exits (the maximum distance from any place in the building to an exit) not exceed 61 m (200 ft). In the 1955 NBC travel distance in assembly occupancies was increased to 45.7 m (150 ft), up from 30.5 m (100 ft). In 1967 it was changed back to 30.5 m (100 ft).

Comment: The travel distance in this building was less than 61 m (200 ft).

(vi) Common Path of Travel

IBC §1013.3 states the common path of travel shall not exceed 22.8 m (75 ft). NFPA 5000 §16.2.5.1.2 limits the common path of travel to 6.1 m (20 ft) or less. Common path of travel is the portion of the means of egress that must be traversed until such a point that at least two independent means of egress to at least two exits are available.

Comment: The common path of travel from the raised seating area and the hallway leading to the rear restroom was greater than 6.1 m (20 ft). If all doors to the exterior were considered exits, all other areas complied with the model codes' common path of travel provisions.

If exit 4 is not considered an exit, over 50% of the sun room and dance floor area have a common path of travel greater than 6.1 m (20 ft).

Not considering exit 3 as an exit does not create additional common path of travel issues.

(vii) Exit Separation

NFPA 5000 §11.5.1.4 and IBC §1014.2.1 requires the exits to be separated by at least one half the length of the maximum overall diagonal dimension of the building area served.

Comments: The diagonal of the area served was 25.3 m (83 ft). The model codes require a separation of 12.6 m (41.5 ft). Exit 1 and exit 2 were 10.4 m (34 ft) apart.

(viii) Dead Ends

IBC §1016.3 states that dead ends in relation to corridors shall not exceed 6.1 m (20 ft). NFPA 5000 §16.2.5.1.3 has the same limit.

While the passage way to the restrooms created a dead end 7.6 m (25 ft) long and the access aisle to the raised seating area was a dead end 7.3 m (24 ft) in length, neither were associated with corridors. No other dead ends existed.

7.3.11 Occupant Load Limits

The model codes compute the occupant load limits in two ways: based upon area, and based upon egress capacity. The limit is set by the calculation that leads to the smaller number. Both of these approaches are described here using the IBC and the NFPA 5000 criteria.

(i) Area Basis

Occupant load factors are expressed in terms of square meters (feet) per person. Dividing the area of the space by the occupant load factor yields the allowable occupant load. The model codes use occupant load factors to determine the allowable number of persons given an area. The relevant occupant load factors from IBC Table 1004.1.2 and NFPA 5000 Table 11.3.1.2 are detailed in the following table.

Table 7-3. Occupant Load Factors, m^2/person (ft^2/person)

Occupancy/Use	IBC Table 1004.1.2 Occupant load factor	NFPA Table 11.3.1.2 Occupant load factor
Assembly, Concentrated (chairs only not fixed)	0.65 (7) net	0.65 (7) net
Assembly, Stand space	0.46 (5) net	no provision
Assembly, Unconcentrated (tables and chairs)	1.39 (15) net	1.39 (15) net
Business area	9.28 (100) gross	9.28 (100) gross
Kitchens commercial	18.6 (200) gross	9.28 (100) gross
Stages and Platforms	1.39 (15) net	1.39 (15) net
Warehouse	46.4 (500) gross	no provision

Table 7-4. Computed Occupant Loads Based Upon Model Codes and Areas Shown in Figures 7-3 and 7-4

Use	Area, m^2 (ft^2)	IBC capacity	NFPA 5000 capacity
Assembly Standing	251 (2709)	542	387
Business	25 (270)	3	3
Platform	35 (373)	25	25
Kitchen	16 (171)	1	1
Storage	64 (690)	3	3
Assembly T/C	15 (161)	11	11
Total	**406 (4374)**	**585**	**430**

IBC §1004.2 allows the occupant load to be increased above the calculated number provided the other egress provisions are met and the occupant load does not exceed 0.46 m^2/person (5 ft^2/person). NFPA 5000 §11.3.1.3 and 16.1.6 contains similar provisions.

Both model codes allow the occupant load to be based on capacity of the means of egress provided each person has 0.46 m^2 (5 ft^2) of floor space. This calculation for available floor space shall be made on net space. Net space excludes restrooms, passageways, and space assigned for other uses such as the space behind the bars and the kitchens.

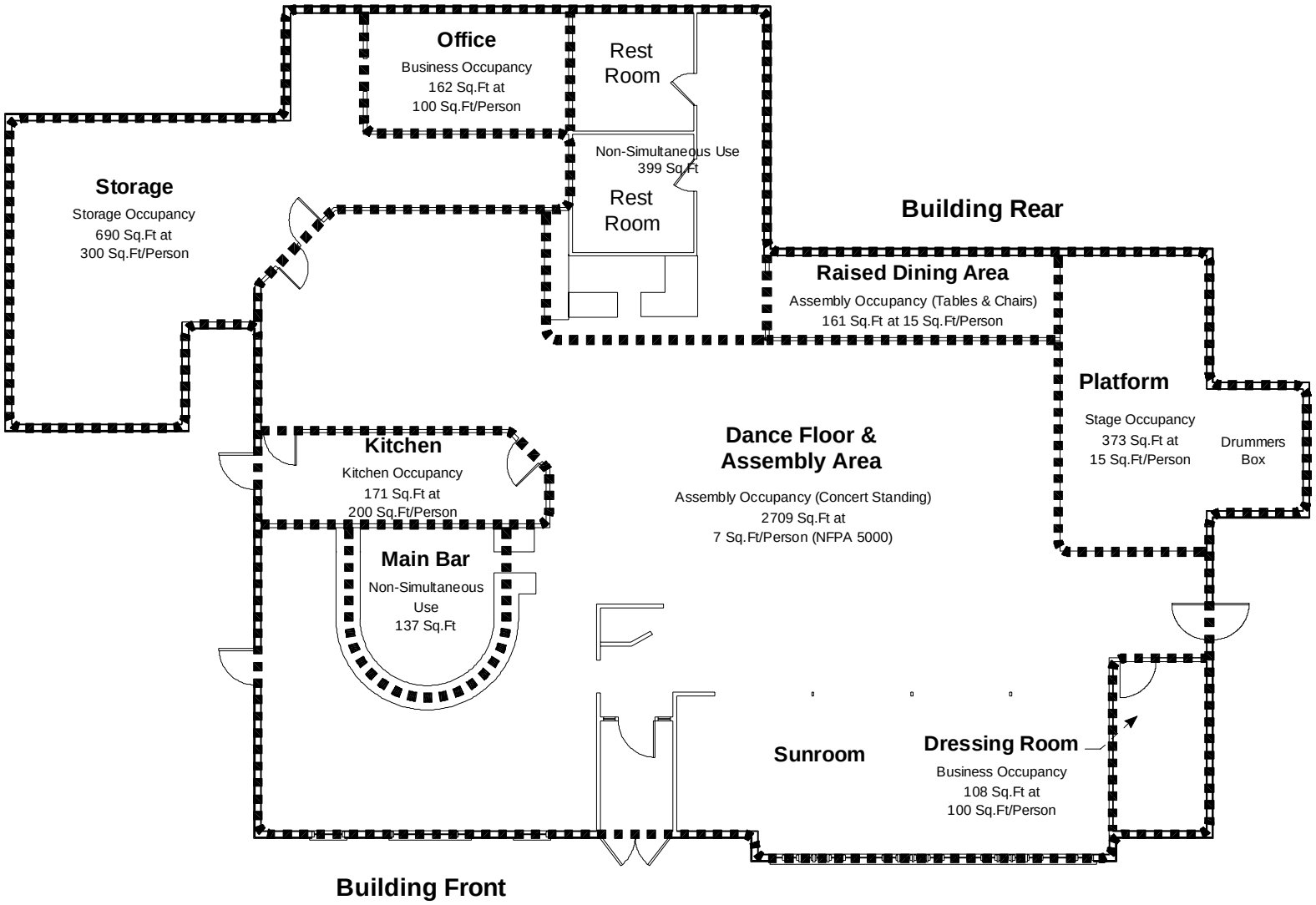


Figure 7-3. Station Nightclub (NFPA 5000) Use Area Designations

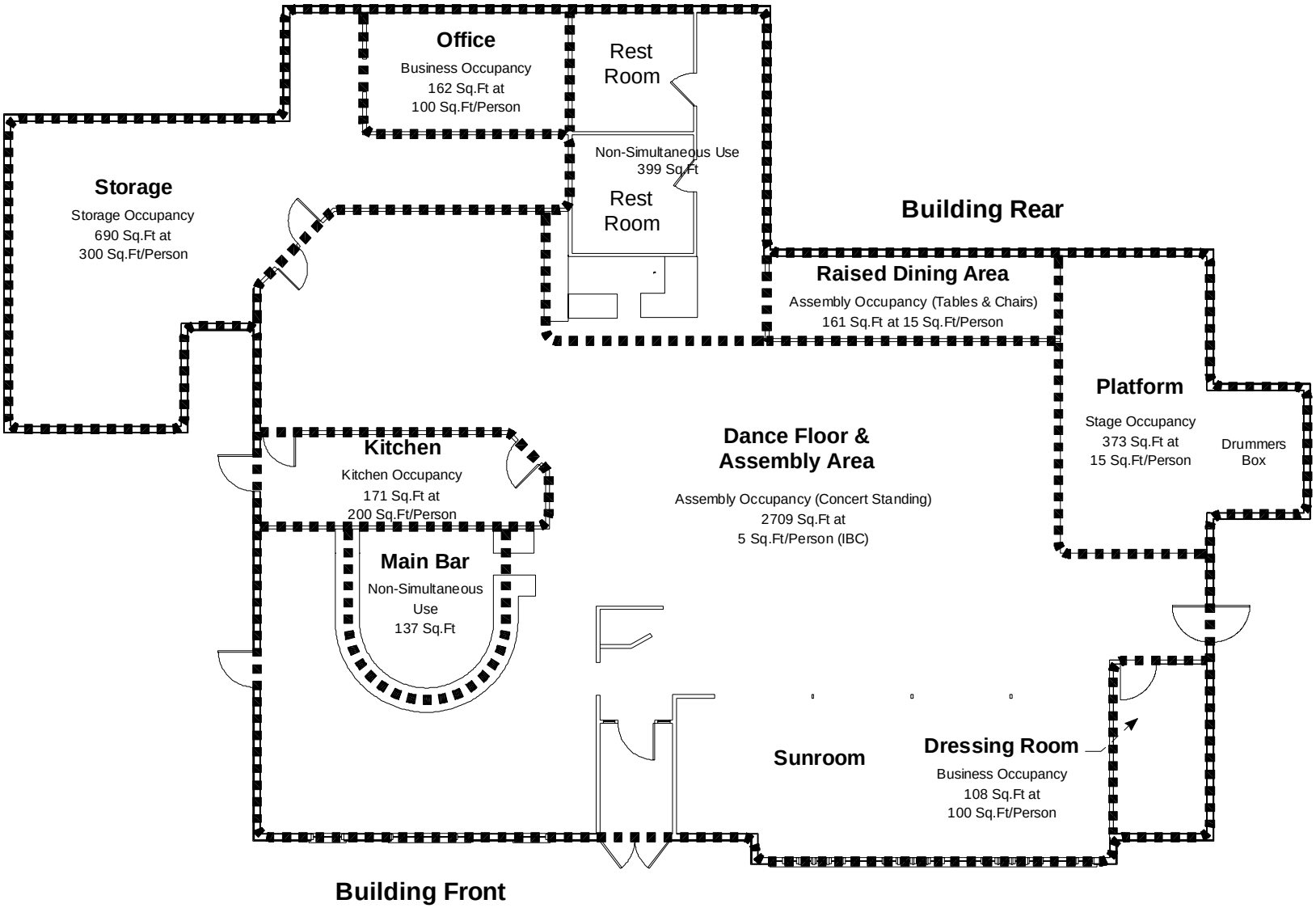


Figure 7-4. Station Night Club Fire (IBC) Occupancy Area Designations

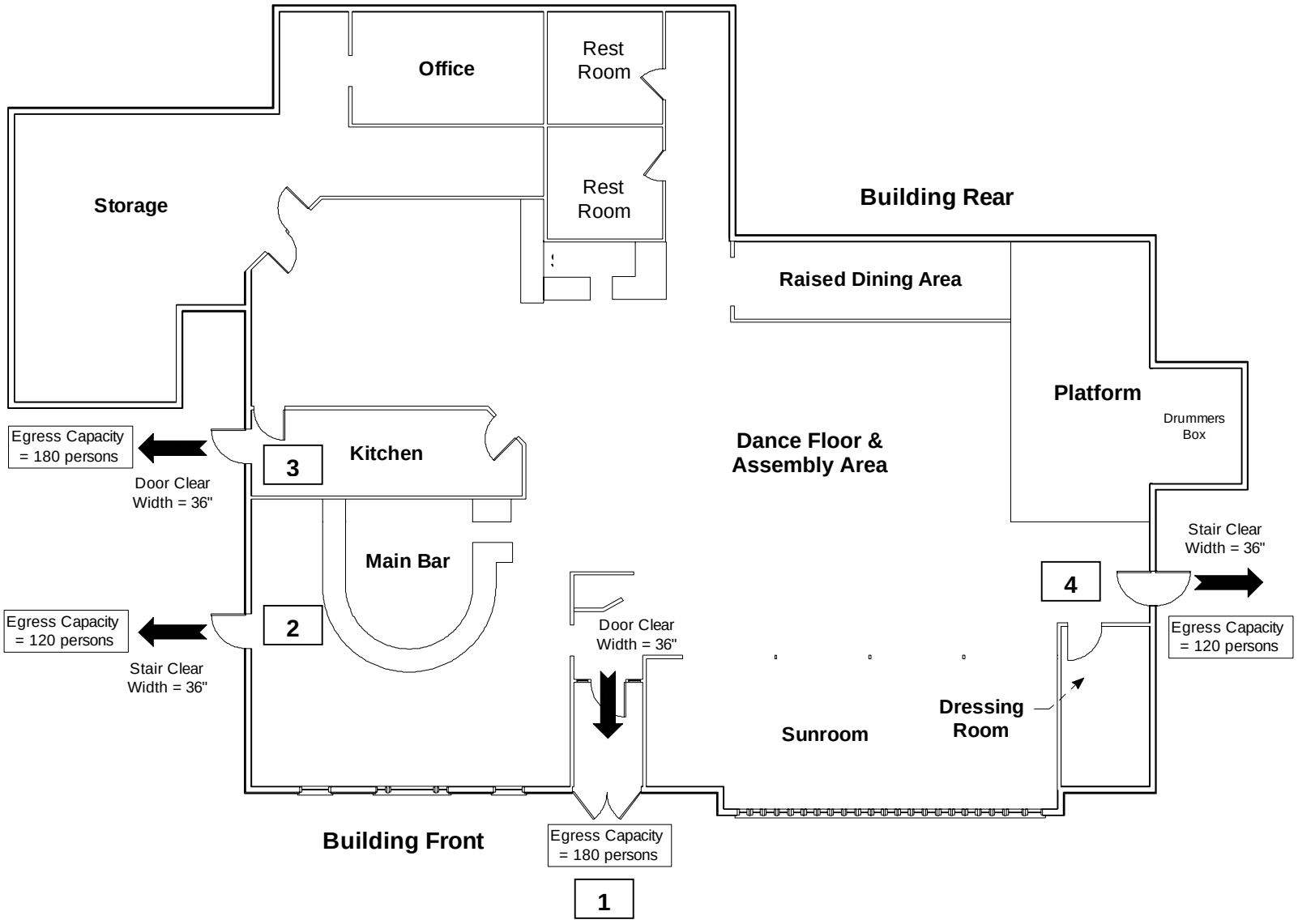


Figure 7-5. Station Nightclub Egress Capacity

Comment: Refer to Figure 7-3 and Figure 7-4 for the use of spaces within the Station as defined by the model codes. Based upon those uses, the maximum load for each space is computed in Table 7-4. The total maximum occupancy of a building similar to The Station, according to IBC, would have been 585 persons; a similar calculation based upon the NFPA 5000 occupant load factors yields a total maximum population of 430 persons. The significant differences arise from NFPA 5000 allowing the use of 0.65 m^2/person (7 ft^2/person) for concentrated assembly occupancy. IBC uses 0.46 m^2/person (5 ft^2/person) for standing assembly space. NFPA 5000 does have a provision that allows the occupant load to be increased to match the available egress capacity. Typically, the table value of 0.65 m^2/person (7 ft^2/person) is used. Both codes would allow these occupant loads, if the exit capacity were available.

(ii) Egress Basis

Egress capacity factors are related to the minimum clear width required for exit pathways in order to ensure timely egress, and are expressed in terms of mm/person (in/person). The egress capacity factors for level egress components and ramps are smaller than factors for stairways. IBC Table 1005.1 and NFPA 5000 Table 11.3.3.1 contain the capacity factors for egress elements. Clear widths are divided by egress capacity factors to yield the maximum capacity for that particular egress element. The IBC reduces the required width when a building is fully sprinkler protected, as shown in Table 7-5. IBC and NFPA 5000 require the number of occupants to be less than the capacity of the available egress width, and both codes require two means of egress for buildings with a total occupant load of less than 501 persons. IBC §1008.1.2 and NFPA 5000 §11.2.1.4.2 contain requirements that doors swing in the direction of egress travel in the path of egress from assembly occupancies serving occupant loads of greater than 50 persons .

Comments: The building was not sprinkler protected.

See Table 7-6 and Figure 7-5 for capacities of each exit. As required by both model codes, the element with the smallest capacity in each path of egress was considered to be the limiting element. The limiting element dictated the capacity of each egress path.

For the main entrance, exit 1, the interior 914 mm (36 in) door was the limiting element, resulting in a capacity of 180 persons for the main entrance exit. For exit 2, the side door out of the main bar area, the exterior stairs leading from the door were the limiting element, resulting in a capacity of 120 persons. Exit 3, from the kitchen, was also limited by an exterior stair; however, both codes prohibit egress by patrons through the kitchen (IBC §1013.2 and NFPA 5000 §11.5.2.1) Exit 4 adjacent to the platform had two doors installed on the same jam, one swinging in the direction of egress travel and one swinging opposing the direction of travel. Excluding the kitchen exit and including the exit adjacent to the platform, the occupancy limit based upon egress capacity would have been 420 according to both model codes. (See Table 7-6.)

Table 7-5. Egress Capacity Factors

Occupancy	Without Sprinkler System, mm/person (in/person)		With Sprinkler System, mm/person (in/person)	
	IBC Table 1005.1	NFPA 5000 Table 11.3.3.1	IBC Table 1005.1	NFPA 5000 Table 11.3.3.1
Level Components and Ramps	5.1 (0.2)	5.1 (0.2)	3.8 (0.15)	5.1 (0.2)
Stairways	7.6 (0.3)	7.6 (0.3)	5.1 (0.2)	7.6 (0.3)

Table 7-6. Egress-limited Occupant Load Calculations					
Element	**Width, mm (in)**	**Clear Width, mm (in)**	**Capacity Fac., mm/person (in/person)**	**Capacity, persons**	**Limiting Element**
Exit 1 - main					
Front Door	1829 (72)	1727 (68)	5.1 (0.2)	340	no
Interior Door	914 (36)	914 (36)	5.1 (0.2)	**180**	**yes**
Stairs (4 risers)	2540 (100)	2438 (96)	7.6 (0.3)	320	no
Ramp	2540 (100)	2438 (96)	5.1 (0.2)	480	no
Exit 2 - bar					
Side Door	914 (36)	914 (36)	5.1 (0.2)	180	no
Stairs (4 risers)	1016 (40)	914 (36)	7.6 (0.3)	**120**	**yes**
*Exit 3 - kitchen**					
Side Door	*914 (36)*	*914 (36)*	*5.1 (0.2)*	*180*	*no*
Stairs (4 risers)	*1016 (40)*	*914 (36)*	*7.6 (0.3)*	*120**	*yes*
Exit 4 - platform					
Side Door	914 (36)	914 (36)	5.1 (0.2)	180	no
Stairs (4 risers)	965 (38)	914 (36)	7.6 (0.3)	**120**	**yes**
			total egress limit	**420***	

* Model codes exclude exiting through a kitchen when computing occupancy limit

7.4 REFERENCES FOR CHAPTER 7

[1] "Code Analysis of the Station Nightclub," KA 03732-004, Koffel Associates, Inc., Ellicott City, MD, June, 2004.

[2] *2003 International Building Code,* International Code Council, Inc., Country Club Hills, IL.

[3] *2003 International Fire Code,* International Code Council, Inc., Country Club Hills, IL.

[4] *NFPA 1, Uniform Fire Code,* National Fire Protection Association, Quincy, MA, 2003.

[5] *NFPA 5000, Building Construction and Safety Code,* National Fire Protection Association, Quincy, MA, 2003.

[6] *The BOCA National Building Code/1993, Twelfth Ed.,* Building Officials and Code Administrators, Inc., Homewood, IL.

[7] *NFPA 101, Life Safety Code,* National Fire Protection Association, Quincy, MA, 2003.

[8] "Evaluation of Limitations to Egress through Doorways in Emergency Situations," vol. 2, Ove Arup & Partners Massachusetts Inc., Job number 32979, Westborough MA, Feb. 18, 2004.

[9] West Warwick, Rhode Island, Building Permit May 18, 1970.

[10] Building Permit October 18, 1971.

[11] Building Permit July, 1, 1975.

[12] West Warwick, Rhode Island Commercial /Industrial Property Record Card May 30, 2001.

[13] *ASTM E84-00a, Standard Test Method for Surface Burning Characteristics of Building Materials*, American Society for Testing & Materials, West Conshohocken, PA, 2001.

[14] *NFPA 255, Standard Method of Test of Surface Burning Characteristics of Building Materials*, National Fire Protection Association, Quincy, MA, 2002.

[15] *NFPA 286, Standard Methods of fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth*, National Fire Protection Association, Quincy, MA, 2002.

[16] American Wood Council. Design for Code Acceptance. awc.org/publications/dca/dca1/dca1.pdf

[17] Canadian Wood Council. Cwc.ca/design/tech_topics/fire/spread_ratings.html